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INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(51) International Patent Classification 6 : B23B 29/06, 29/08 — A1

(11) International Publication Number: WO 99/00208

(43) International Publication Date: 7 January 1999 (07.01.99)

(21) International Application Number: PCT/SE98/01146

(22) International Filing Date: 15 June 1998 (15.06.98)

(30) Priority Data:
9702500-1 30 June 1997 (30.06.97) SE

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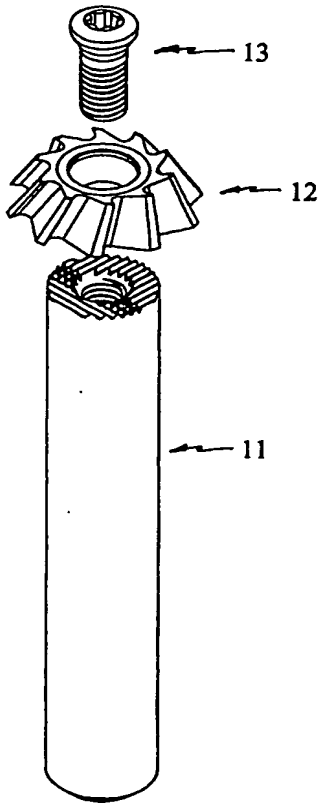
(81) Designated States: BR, CN, CZ, IL, JP, KR, PL, European patent (AT, BE, CH, CY, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE).

Published
With international search report.

(54) Title: TOOL COUPLING AND METHOD FOR COUPLING TWO TOOL PARTS

(57) Abstract

The present invention relates to a coupling, a tool, a cutting head, a holder, a shim and a method for application at chip removing machining. The tool comprises a cutting head (12) and a holder (11), wherein the cutting head and the holder comprise two cooperating surfaces and a screw (13) for forcing the surfaces together. The surfaces are profiled with grooves for allowing locking by shape against each other. The cooperating surfaces (14, 22) allow at least four separate positions in relation to each other by means of a special waffle pattern.



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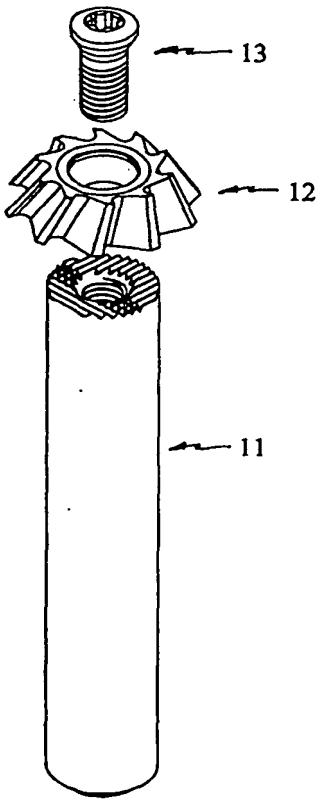


TOOL COUPLING AND METHOD FOR COUPLING TWO TOOL PARTS

Background of the invention

The present invention relates to a coupling, a tool, a cutting head, a holder, a shim and a method according to the preamble of respective independent claim.

Prior art

Through DE-A1-34 46 455 is previously known a turning tool of the above-mentioned type. The known tool has four teeth at the lower side of the cutting insert which cooperate with corresponding grooves in the holder. The strain on each individual groove becomes large and the wear leads subsequently to poor precision in the machining result. The same applies for a tool according to DE-C2-34 48 086 and DE-OS-19 50 718 which include radially projecting teeth.

Through CA-A-2,170,450 is another turning tool of the above type previously known, wherein a lower side of a shim is provided with a fine pattern of protrusions intended to directly stamp a corresponding pattern into the holder at turning. Said stamping will however happen successively and therefore the screw which holds the cutting insert looses clamping force and must be retightened. In addition the repetitive accuracy becomes bad at exchange of shim since it is almost impossible to find the original position again but new stamping must be made so that the locking effect deteriorates for each exchange.

Further is referred to applicants SE-A-9404266-0 and SE-A-9501687-9 which show tool with cooperating grooves and teeth provided in one direction.

Objects of the invention

One object of the present invention is to provide a universal coupling for two tool parts, whereby a great torque can is transferred.

a tool according to the present invention, respectively, in an exploded view and in a perspective view; Fig. 8C shows, from above and downwards, a shim in a bottom view, a side view and a top view, respectively; Fig. 8D shows an alternative embodiment of a cutting head according to the present invention in a bottom view and in a side view; Fig. 9A-C show an alternative embodiment of a tool, a holder and a cutting head according to the present invention in perspective views.

Technical analysis of transferred torques in couplings

Hereinafter follows a technical analysis of founding theory behind the present invention. Look at a square surface with the length of the side a which has N pieces of milled longitudinally parallel grooves with a width or partition W, see Fig. 1A. Relative to an opposite surface with a similar groove is assumed that for an individual groove a relative torsion can be made within an angle $\varphi 1$. This can be said to be the measure of the gap between both surfaces for a groove. When N pieces of grooves simultaneously influence each other a cooperation is obtained which reduces the total relative torsion inverted proportionally with the number of grooves according to:

$$\varphi = \varphi 1/N$$

Now look at the same surface but with N/2 pieces of grooves milled along half the length, a/2. On the other half there are N pieces of grooves with the same profile and partition as above but milled 90° in relation to the other grooves, see Fig. 1b. When an opposite surface, with N+N pieces of grooves milled 90° relative to each other, influences the other surface an engagement is attained between total N+N/2 pieces of grooves. If the relative torsion for a groove is as before $\varphi 1$, the total relative torsion obtained is

$$\varphi = \varphi 1/(N+N/2) = 2\varphi 1/3N$$

Detailed description of preferred embodiments of the invention

Said theoretical reasoning constitutes the basis for a number of embodiments of the invention, of which some are described hereinafter.

Figs. 2A to 2D shows a tool 10 for milling including a substantially cylindrical holder 11, a multi-edged cutting head 12 and a screw 13.

The holder 11 can be made of steel, cemented carbide or high speed steel. One free end of the holder 11 is intended to be fastened in a rotatable spindle (not shown) in a milling machine while the opposed second free end comprises a front surface 14 and a threaded hole 15. The threaded hole 15 has a conical entering bevel. The front surface 14 has a circular basic shape and comprises two groove parts 16A, 16B. Each groove part covers substantially half the front surface 14 and comprises a number of from each other separate, identical flutes or grooves 17A, 17B. The grooves in the groove parts have two main directions S1, S2, which are perpendicular to each other. A second groove part 16A is bordered by a first groove part 16B. Substantially each groove 17B in the first groove part 16B intersects the jacket surface of the holder in two places, while substantially each groove 17A in the second groove part 16A intersects the jacket surface of the holder in one place. Each groove 17A, 17B is elongated as well as substantially v-shaped in cross-section. Each groove has a largest partition or width W and a depth. The width W is in the magnitude of 0,2 to 2 mm, preferably around 1,5 mm. Each groove has two flanks which, via a sharp or rounded transition, connects to a bottom. The flanks form an acute angle with each other. The angle lies in the interval 40° to 80°, preferably 55° to 60°. Each surface is preferably planarly formed and connects to the associated flank via an obtuse inner, soft or sharp, transition. The number of grooves in each groove part depends of how of the cutting head support surface is formed and the number is chosen in the interval 5 to 20 grooves. The bottom can alternatively be described with a radius of about 0,2 to 0,4 mm. The design of the groove parts 16A, 16B gives a considerably bigger specific surface than if these should

24A, 24B is elongated and substantially v-shaped in cross-section. Each groove has a largest width W and a depth. Each groove has two flanks which, via a sharp or rounded transition, connect to a bottom. The flanks form an acute angle with each other. The angle lies in the interval of 40° to 80°, preferably 55° to 60°. Each surface is preferably planarly formed and connects to the associated flank via an obtuse inner, soft or sharp, transition. The number of grooves in each groove part depends of how the front surface of the holder is formed and the number is chosen in the interval of 5 to 20 grooves. The bottom may alternatively be described by a radius of about 0,2 to 0,4 mm. The design of the groove parts 23A, 23B give a considerably larger specific surface than if this would be planar. The groove parts 23A, 23B cover at least 80%, preferably 90-100%, of the accessible area on the support surface 22. The groove parts 23A, 23B are displaced relative to the tool's axis of rotation CL a distance W/2 relative to both directions S1 and S2 for the groove parts 16A and 16B of the holder 11. The head has an unthreaded hole 25 to receive a screw or any other clamping means. The clamping means may alternatively be developed as an internal pull rod, wherein the hole 25 comprises an integral thread which cooperates with a threaded free end of the pull rod. At said alternative the possibility to provide cutting edges towards the rotational axis for drilling is obtained. In the in Fig. 2B shown embodiment the groove parts 23A, 23B have been made through direct pressing and sintering or through grinding.

The milling tool 10 is mounted by putting the support surface 22 of the cutting head 12 by hand against the front surface 14 of the holder 11 in one of four possible positions. Thereby the groove directions S3 and S4 are aligned with the groove directions S1 and S2, respectively. The screw 13 is brought through the insert hole 25 and against the threaded hole 15. At rotation of the screw 13 via a key which is in engagement with the key grip, the cutting head will be drawn firmly against the front surface, i.e. the position according to Fig. 2D has been achieved. The cutting head 12 is now anchored in the holder 11 in a satisfactory manner.

cemented carbide and comprises two upper clearance surfaces, a support surface 22 as well as them connecting first and second curved surfaces. All these surfaces and associated edges are made in the same material, i.e. preferably in injection moulded cemented carbide. Lines of intersection between the second curved surfaces or the chip flutes and the clearance surfaces form main cutting edges, preferably via reinforcing chamfers, not shown. Lines of intersection between the first curved surfaces and the chip flutes form secondary cutting edges. The chip flute can alternatively be adapted for a drill body with straight chip flutes. The cutting head preferably also comprises a coring-out surface, which reaches the center of the cutting head. The biggest diameter of the cutting head consists of the diametral distance between the radially extreme points of the secondary cutting edges. The height of the cutting head is substantially the same as said distance, in order to minimize the wear from chips on the joint between the cutting head and the drill body. The biggest diameter of the support surface 16 is preferably less than the biggest diameter of the cutting head, in order to provide clearance at machining. Flushing holes, substantially parallel with the rotational axis, run through the cutting head from the support surface 22 to the orifice in respective upper clearance surface. The flushing holes are provided on a line L, at each side of the rotational axis. The function of the drill tool is also described in applicants SE-A-9501687-9, which hereby is incorporated in the present description as regards the external geometry of the drill and the clamping of the cutting head to the drill body.

The support surface 22 of the cutting head is formed in accordance with what has been described in connection with Fig. 2B except for that the support surface 22 in this case comprises the flushing channels around a central, threaded hole and that the support surface is cut by chip flutes. The direction S1 is parallel with the line L and the direction S2 is perpendicular thereto.

The drill body 42, Figs. 6A-6C, is equipped with flush channels, which follow the protruding lands of the drill along a helical path at a distance from the rotational axis. The drill body has screw shaped chip flutes or straight chip flutes and these

In Figs. 8A-8D is shown an additional embodiment of a tool according to the present invention. The tool is a tool 60 for longitudinal turning and comprises a holder 61, a round cutting insert 62, a screw 63, a shim 64 and a clamp 65. The holder 61 consists of a square shank and has a position for mounting of the shim 64. The position comprises two groove parts 16A, 16B such as been explained above in connection with Fig. 2A. The cutting insert 62 is circular and consequently has a round cutting edge and may have somewhat angled clearance surfaces. The lower side of the cutting insert is provided with a support surface such as explained in connection with Fig. 2B, which is more closely shown in Fig. 8D. The grooves in the groove parts 16A, 16B can be parallel and perpendicular, respectively, to an axis of rotation of a work piece or be angled to obtain sufficient clearance when a polygonal cutting insert for longitudinal turning shall be used. The cutting insert and the shim 64 are preferably made by injection moulded cemented carbide. The shim 64 is circular and its underside comprises like the cutting insert 62 lower side rows of grooves or pyramids. The upper side of the shim 64 is like the cutting insert position of the holder 61 equipped with two groove parts 16A, 16B. The shim furthermore has a unthreaded through-going hole. The tool is mounted by putting the lower side of the shim by hand against of the holder 61 in one of four possible positions. Thereby the groove directions S3 and S4 are aligned with the groove directions S1 and S2, respectively. The screw 63 is brought through the insert hole and against a threaded hole in the holder 61. At rotation of the screw via a key the shim is drawn firmly against the front surface. When the cutting insert 62 shall be mounted the procedure is repeated, namely that the lower side of the cutting insert is put against the upper side of the shim in one of four possible positions. Thereby the groove directions S3 and S4 are aligned with the groove directions S1 and S2, respectively. The clamp 65 then firmly clamps the cutting insert in position with the aid of a threaded hole in the holder, whereafter the position according to Fig. 8B is achieved. In an alternative embodiment the upper side of the shim is rotated 45° in relation to the lower side, and therefore such a shim allows the use of four further cutting edge portions on the round the cutting insert. Naturally, the upper side of the cutting insert in a double sided

turning at least four cutting edges or cutting edge portions can be indexed and be distinctly held.

5. Tool comprising a coupling as defined in claim 1 between a cutting head (12;41;52;62;72) or a shim (64) and a holder (11;42;51;61;71), wherein the cutting head/the shim and the holder comprise two cooperating surfaces (14,22) and means (13;53;63,65;73) for forcing the surfaces together, wherein said surfaces are profiled with grooves for allowing locking by shape against each other,

c h a r a c t e r i z e d in that the cooperating surfaces (14,22) are provided to comprise at least four separate positions in relation to each other, wherein the number of grooves(17A,17B,24A,24B) is more than the number of positions and that each surface (14,22) comprises at least two groove parts (16A,16B,23A,23B) which comprise said grooves and which parts are provided preferably substantially perpendicular to each other and in that one (16B) of the groove parts in the first part (11;42;51;61;71) borders another groove part (16A).

6. Tool according to claim 5,

c h a r a c t e r i z e d in that the groove parts (23A,23B) in the second part (12;41;52;64,62;72) wholly transverse each other.

7. Tool according to claim 5 or 6,

c h a r a c t e r i z e d in that the grooves (17A,17B,24A,24B) in the respective groove part (16A,16B,23A,23B) are essentially V-shaped and displaced in a plane in relation to each other as mounted and that the grooves have a width (W) as well as are displaced a half width (W/2) in said plane.

8. Tool according to claim 5, 6 or 7,

c h a r a c t e r i z e d in that the groove parts (16A,16B,23A,23B) cover at least 80%, preferably 90-100%, of accessible area of the associated surface (14,22) and that the grooves in each surface (14,22) have two main directions (S1,S2,S3,S4), which are perpendicular to each other and that the coupling is intended for rotary and/or stationary tools.

(14) comprises at least two groove parts (16A,16B) which comprise said grooves and which parts preferably are provided substantially perpendicular to each other and in that one (16B) of the groove parts in the holder (11;42;51;61;71) borders another groove part (16A).

13. Holder according to claim 12,
c h a r a c t e r i z e d in that the grooves (17A,17Bb) in the respective groove part (16A,16B) have identical basic shape and are essentially V-shaped and that the grooves have a width (W).

14. Holder according to claim 12 or 13,
c h a r a c t e r i z e d in that the groove parts (16A,16B) cover at least 80%, preferably 90-100%, of accessible area of the associated surface (14) and that the grooves in the surface (14) have two main directions (S1,S2), which are perpendicular to each other.

15. Shim to be used in a tool according to claim 5 for connection to a holder, wherein the shim (64) and the holder comprise cooperating surfaces (14) and means for forcing the support surfaces together, wherein the surfaces are profiled with grooves for allowing locking by shape against each other, /wherein said shim has a lower side (22) and an upper side (14),
c h a r a c t e r i z e d in that the lower side (22) of the shim (64) is provided to comprise at least four separate positions, wherein the number of grooves is more than the number of positions and that said side (22) comprises at least two groove parts (23A,23B) which comprise said grooves and which parts are provided preferably substantially perpendicular to each other.

16. Shim according to claim 15,
c h a r a c t e r i z e d in that the upper side (14) of the shim (64) is provided to comprise at least four separate positions, wherein the number of grooves is more than the number of positions and that said side (14) comprises at least two

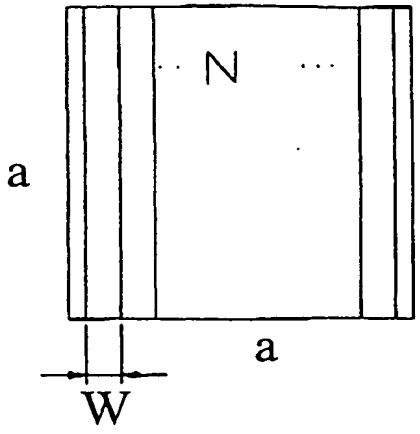


Fig. 1A

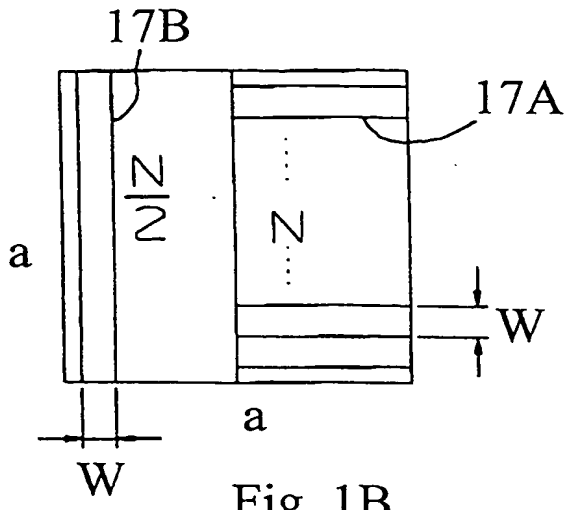


Fig. 1B

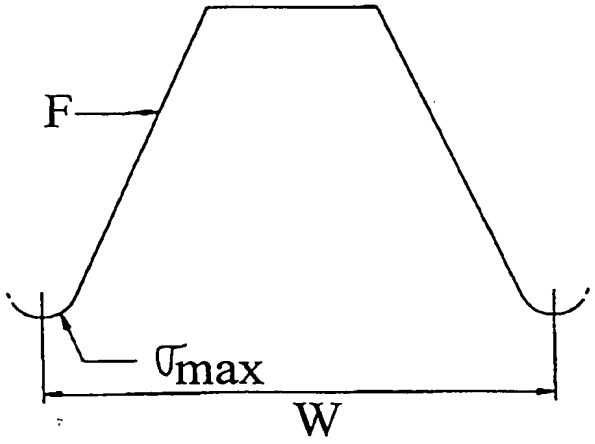


Fig. 1C

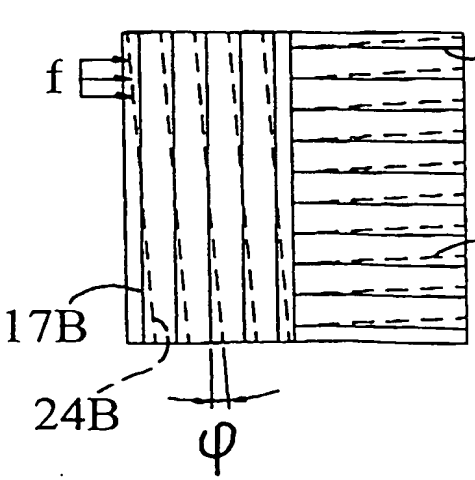


Fig. 1D

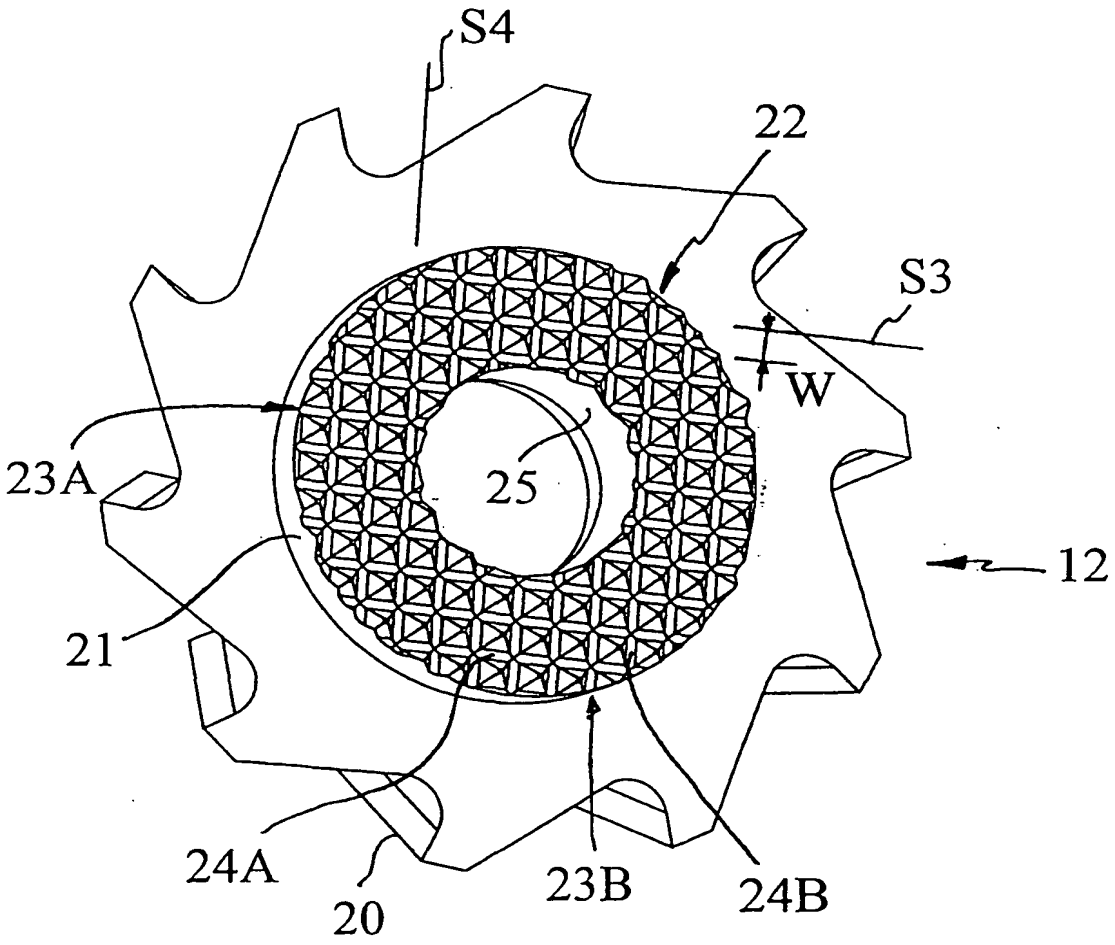


Fig. 2B

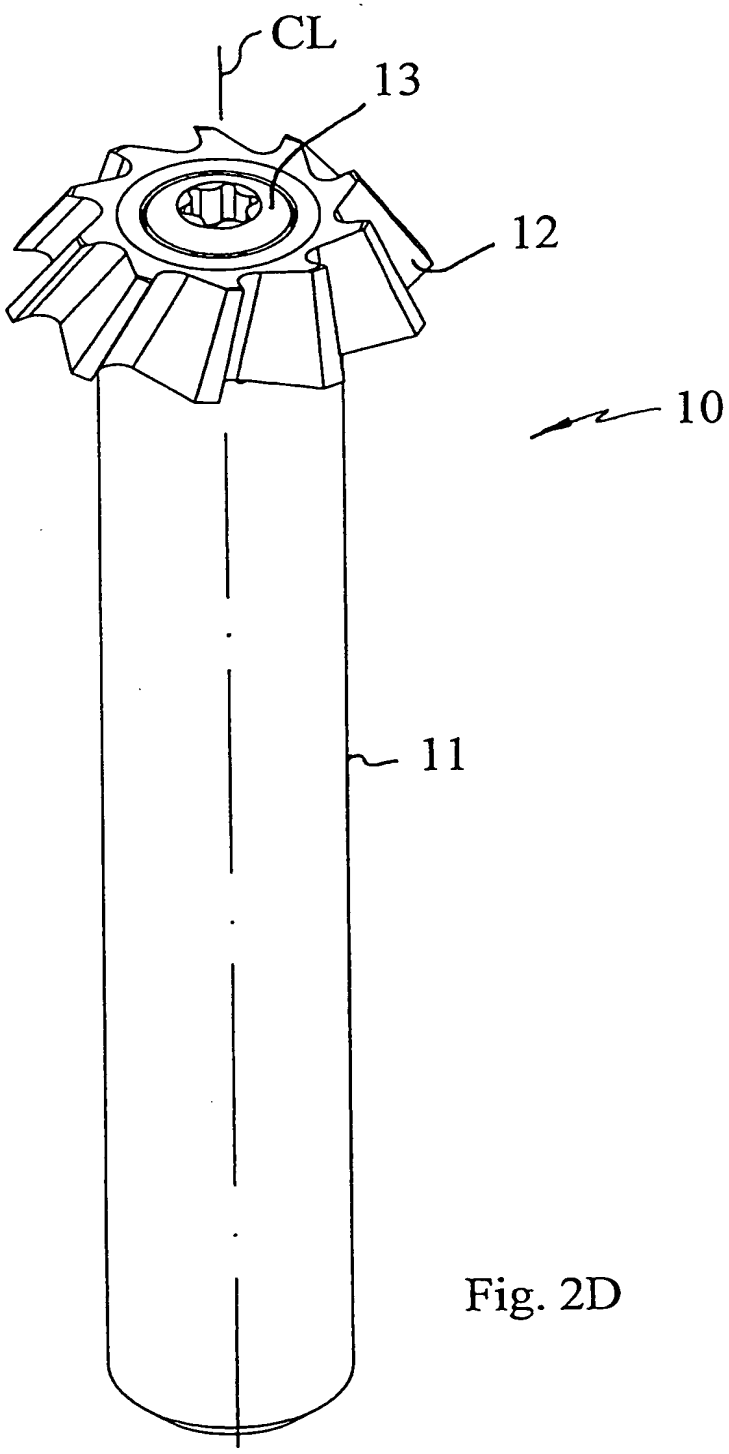
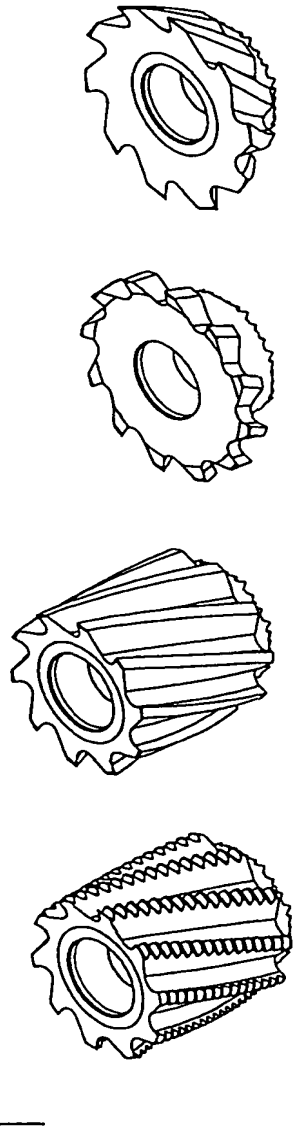


Fig. 2D

Fig. 3



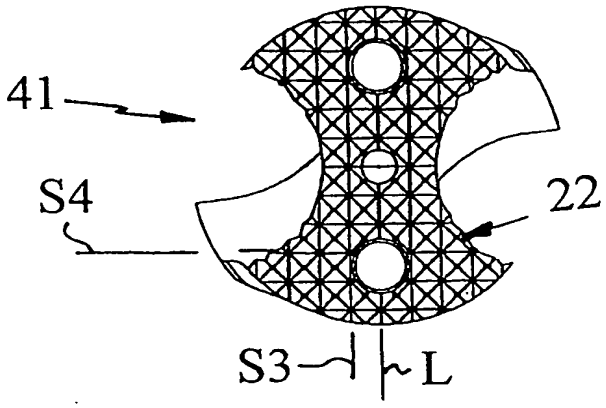


Fig. 5C

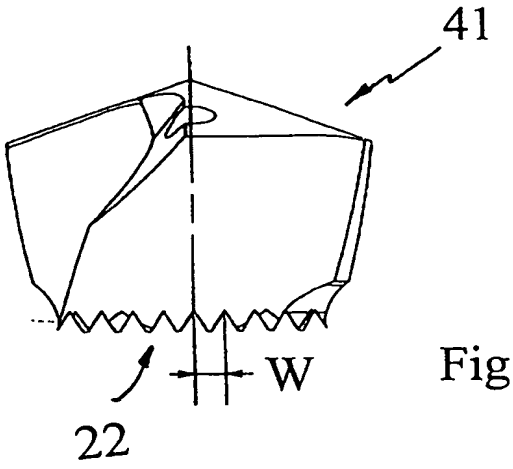


Fig. 5B

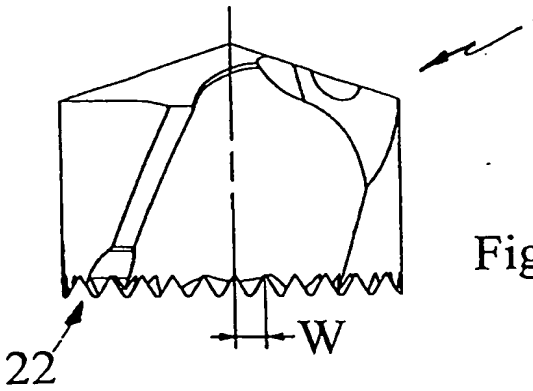


Fig. 5A

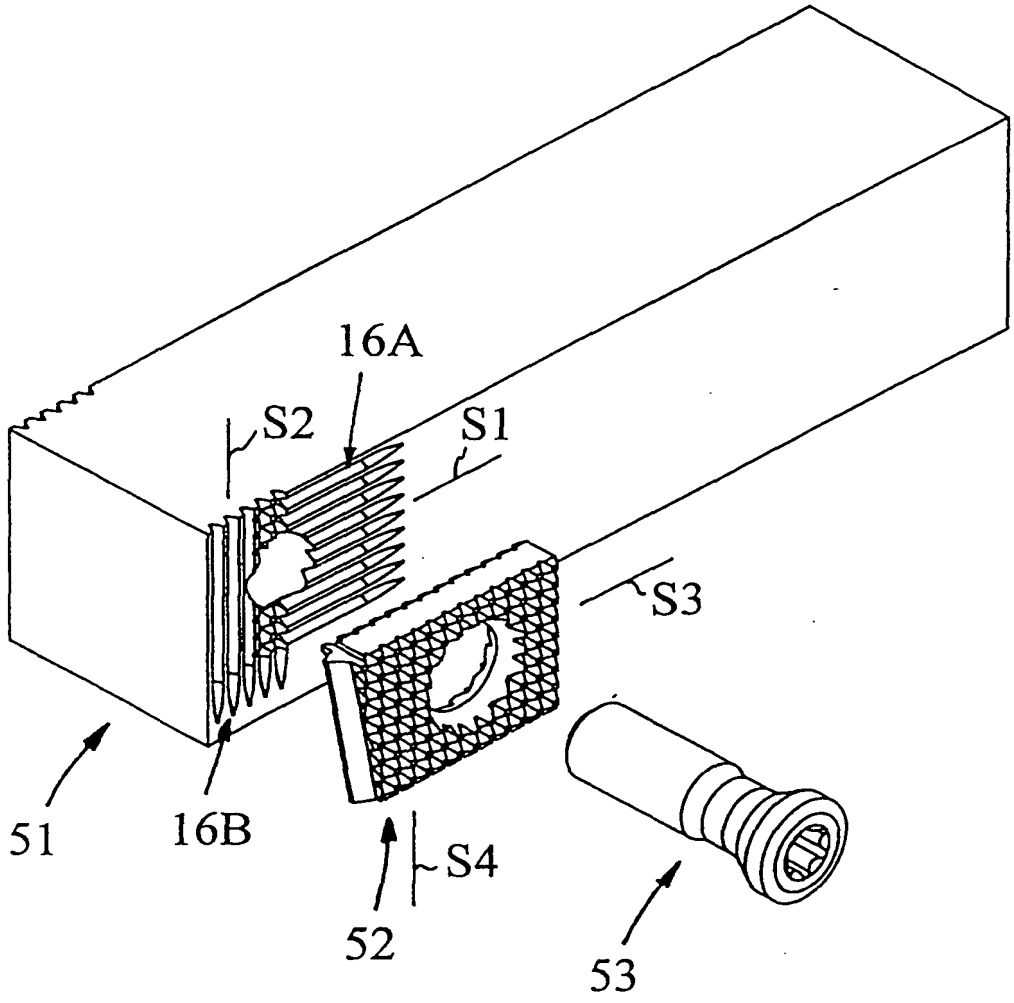


Fig. 7A

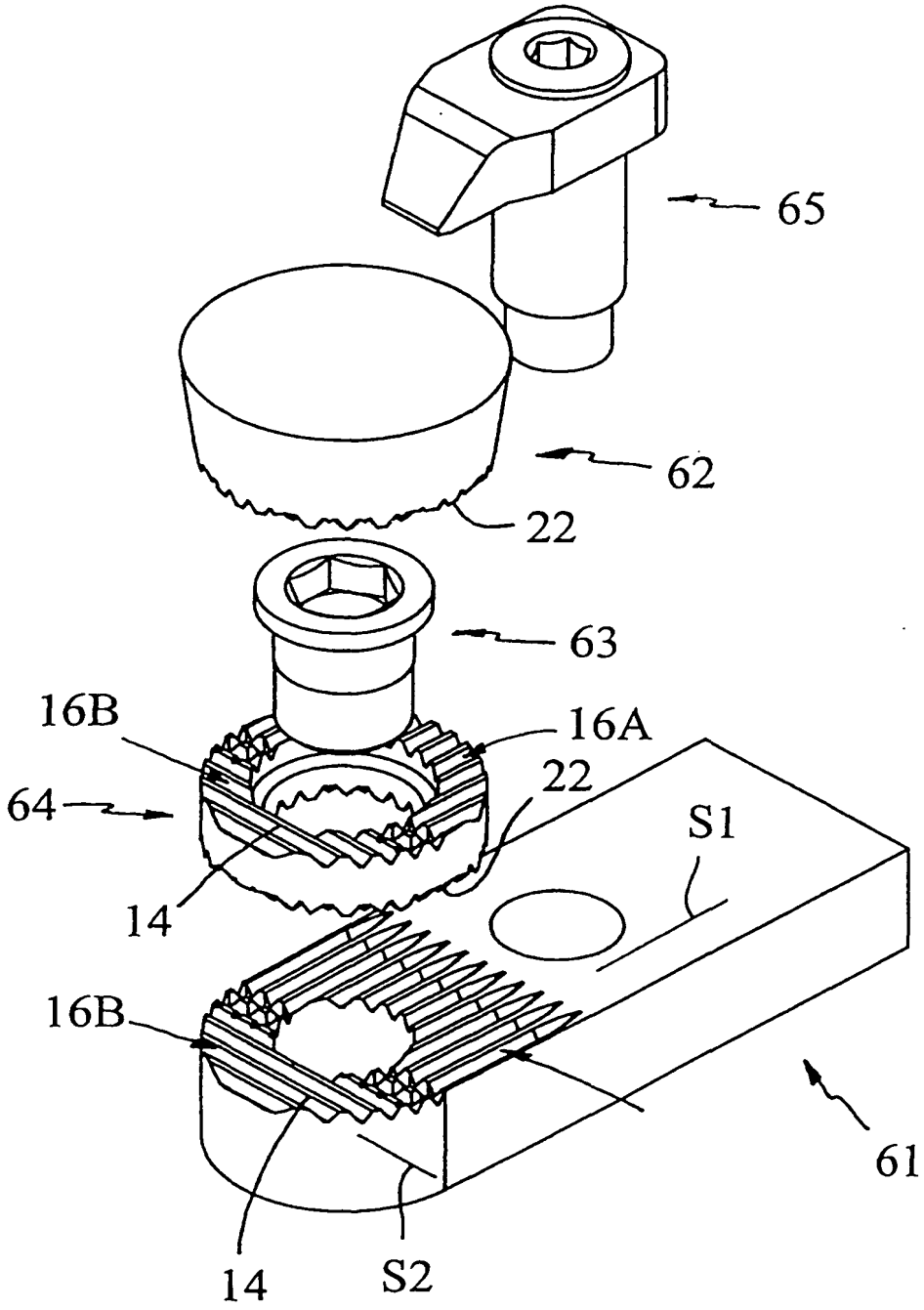


Fig.8A

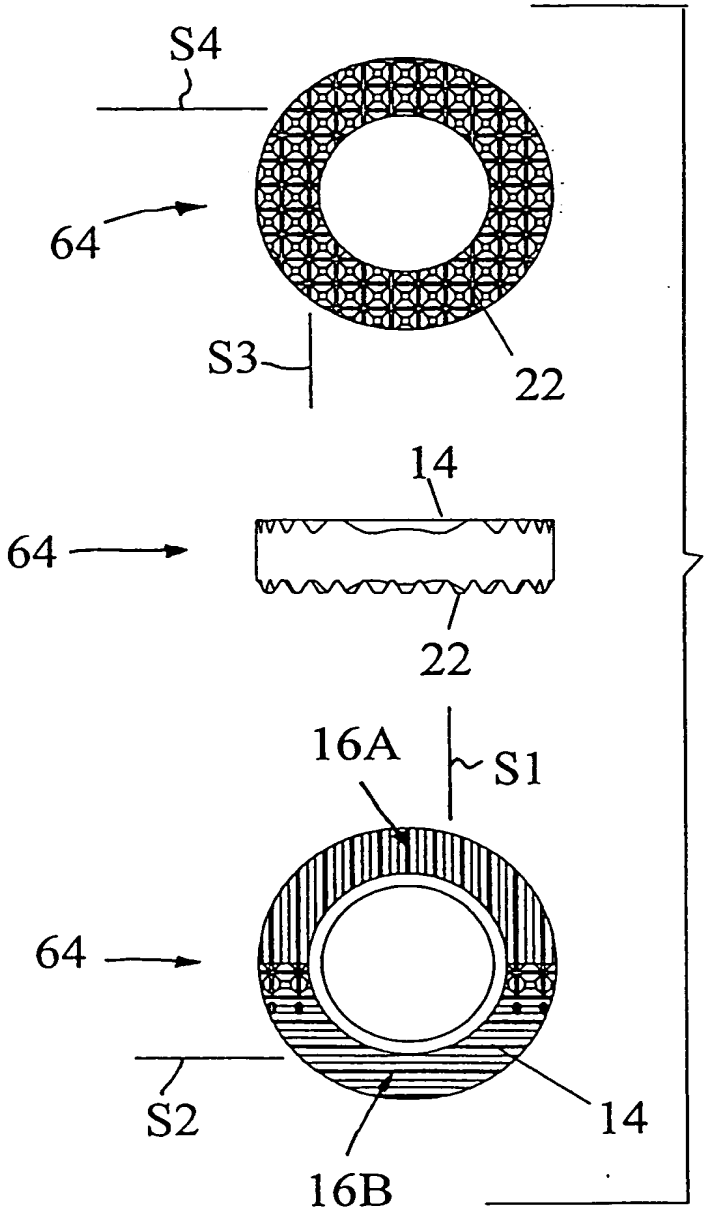


Fig. 8C

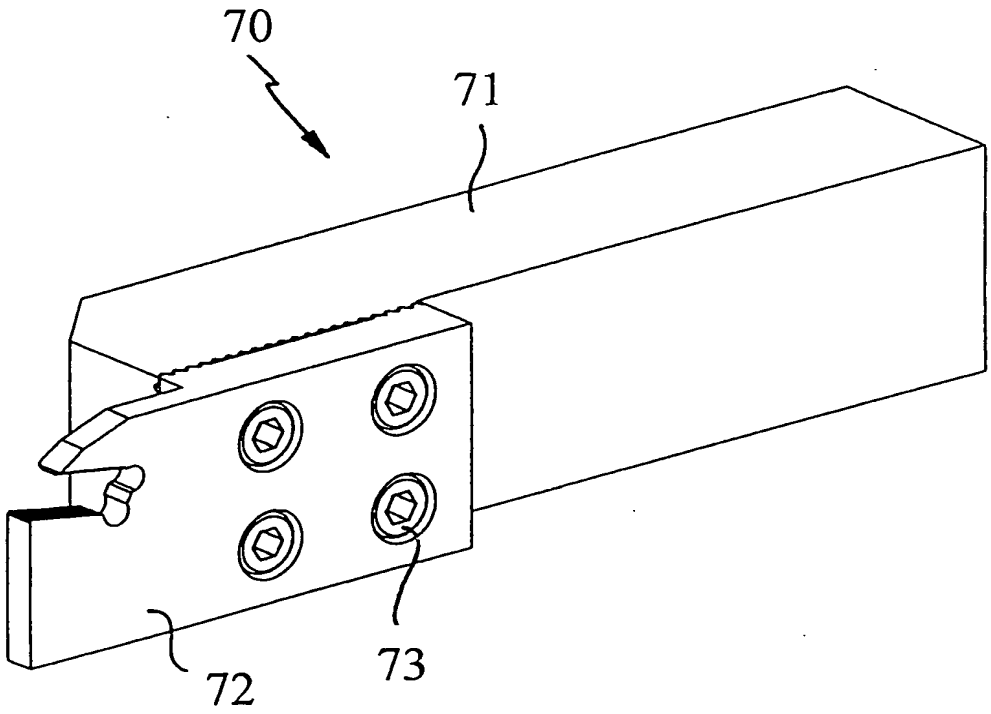


Fig. 9A

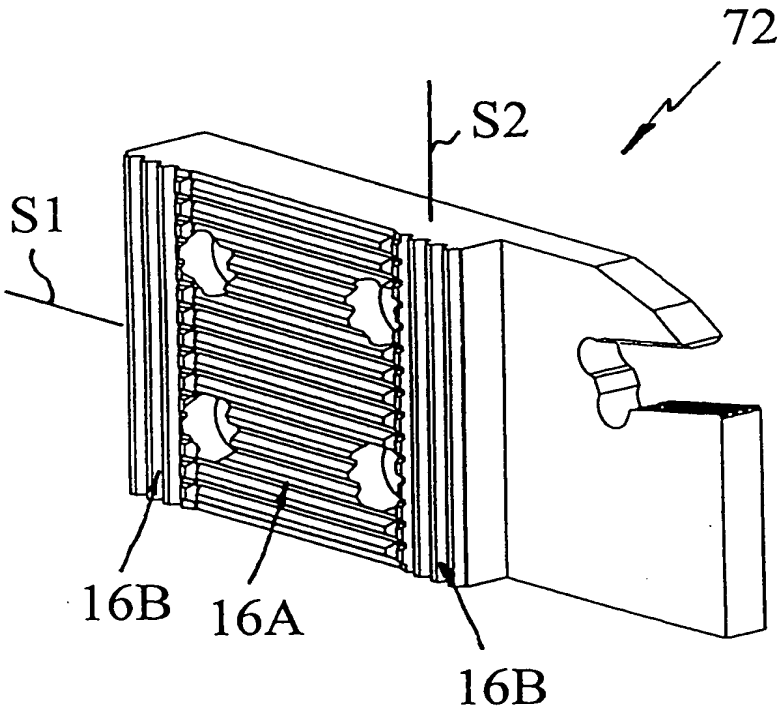


Fig. 9C

INTERNATIONAL SEARCH REPORT

Information on patent family members

27/07/98

International application No.
PCT/SE 98/01146

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 2779992 A	05/02/57	NONE	
US 2623272 A	30/12/52	NONE	
DE 3446455 A1	26/06/86	NONE	

?S PN=FR 2431897
S1 1 PN=FR 2431897
?T S1/5

1/5/1
DIALOG(R)File 352:Derwent WPI

002335374
WPI Acc No: 1980-E1816C/198019
Cutting plaquette for milling cutter - has cuboid plate formed with uniform trapezoidal teeth along major face in direction of cut
Patent Assignee: IGMAN SA (IGMA-N)
Number of Countries: 001 Number of Patents: 001
Patent Family:

Patent No	Kind	Date	Applicat No	Kind	Date	Week
FR 2431897	A	19800328				198019 B

Priority Applications (No Type Date): FR 7822007 A 19780725

Abstract (Basic): FR 2431897 A
The cutting insert may be of tungsten carbide and be bolted onto the barrel of a cylindrical milling cutter. It has a cuboid outline with a square shape in tangential cutter planes and a relatively shallow radial thickness. The major faces are of a uniform trapezoidally undulating profile forming teeth(8) bounded by grooves of reciprocal section. The grooves run the length of the insert in the direction of cut.
The leading and trailing faces(4, 6) may be concave with plane edge margins(13) forming right angles linear arrisses at the head and foot. The remaining sides(5, 7) may be similarly concave in perpendicular planes, and the cutter barrel may have locally grooves zones for positive insert location.
Title Terms: CUT; PLAQUE; MILL; CUT; CUBE; PLATE; FORMING; UNIFORM; TRAPEZOID; TOOTH; MAJOR; FACE; DIRECTION; CUT
Derwent Class: P54
International Patent Class (Additional): B23C-005/22
File Segment: EngPI